NNG08ZOOC Geostationary
Lightning Mapper GLM GOES-R
Attachment D Unique Instrument
Interface Document

Geostationary Operational Environmental Satellite (GOES)

GOES-R Series

Geostationary Lightning Mapper (GLM)

Unique Instrument Interface Document (UIID)

December 27, 2006

National Aeronautics and
Space Administration ———

Goddard Space Flight Center
Greenbelt, Maryland

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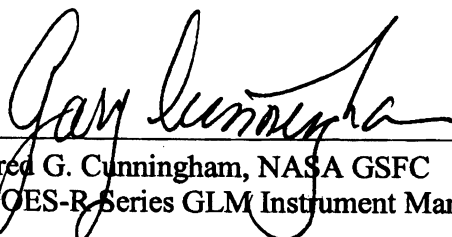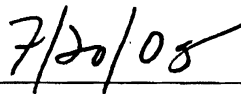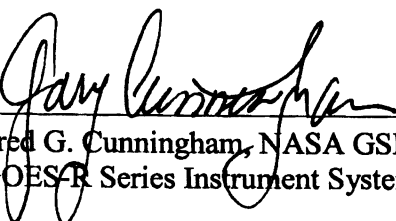Management Office*

Geostationary Operational Environmental Satellite (GOES)
GOES-R Series
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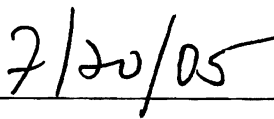
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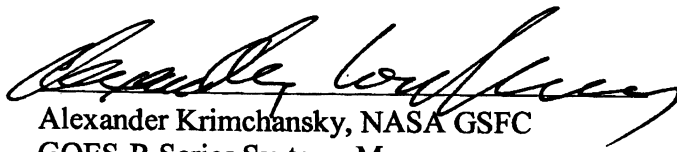
_____   7/20/08
Fred G. Cunningham, NASA GSFC   Date
GOES-R Series GLM Instrument Manager (Acting)

Reviewed By:
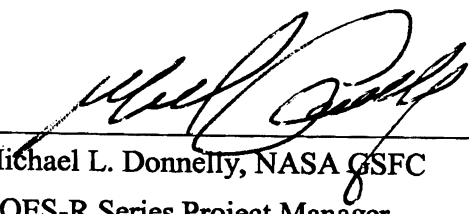
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Fred G. Cunningham, NASA GSFC   Date
GOES-R Series Instrument Systems Manager
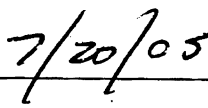
_____   7/20/05
Alexander Krimchansky, NASA GSFC   Date
GOES-R Series Systems Manager

Approved By:

_____   7/20/05
Michael L. Donnelly, NASA GSFC   Date
GOES-R Series Project Manager

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/GLM

GLM UIID

417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)

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Contents

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID1	1	**1 Scope**

GLMUIID2 — 1.0-1

The purpose of this Unique Instrument Interface Document (UIID) is two-fold. The first is to allocate GOES-R series spacecraft resources to the Geostationary Lightning Mapper (GLM). The second is to serve as a core building block on which the GLM-spacecraft interface can be designed.

GLMUIID3 — 1.0-2

The spacecraft integrating contractor and the GLM contractor **shall** meet each of their respective interface requirements as defined in this document.

GLMUIID4 — 1.0-3

The Government will be the system integrator until a system performance contractor or spacecraft contractor with that responsibility is selected. Until that time, the Government will be responsible for accommodation trades, resource allocation (weight, power, space, bandwidth, etc.), and resolving interface issues. This UIID will govern the development of an Interface Control Document (ICD) which will be a joint activity of the GLM and spacecraft contractors.

GLMUIID5 — 1.0-4

The GLM ICD establishes the details of the electrical, communications, mechanical, thermal, integration and test, and command and data handling (C&DH) interfaces between the GLM instrument and the GOES-R spacecraft.

GLMUIID6 — 1.0-5

After the ICD is signed and approved by all parties, the spacecraft contractor **shall** maintain the ICD.

GLMUIID7 — 1.0-6

The GLM is a single-wavelength, non-scanning imaging instrument designed to detect lightning. The instruments collect data on a three-axis body-stabilized satellite in geosynchronous orbit.

Probability of detection and false alarm, coverage, resolution and geolocation accuracy are prime requirements of the system. The instrument requires primary power and command input data from the spacecraft. Instrument output data to the spacecraft contains instrument information, instrument telemetry and ancillary data.

The sensor units contain the optical system, detectors and their cooling systems, if required, and directly related electronics. The electronics unit contains the power supply module, command, control, and data processing circuitry.

GLMUIID8 — 1.1

1.1 Document Overview

GLMUIID9 — 1.1.0-1

Together, the General Interface Requirements Document (GIRD) and the GLM UIID establish the GLM-spacecraft interface requirements. The GIRD applies to all GOES-R instruments while the GLM UIID is specific to the GLM. Section 1 explains the use of this document. Section 2 lists reference documents. Section 3 allocates spacecraft resources, such as mass, power, and data rate, to the GLM instrument. Section 4 contains government-accepted operation constraints. Section 5 contains government-accepted deviations from the GIRD. Section 6 contains a list of acronyms used within this document.

GLMUIID10 — 1.2

1.2 Missing Requirements

GLMUIID11 — 1.2.0-1

This document contains all performance requirements for the sensor except those labeled "TBD," "TBS," and "TBR". The term "TBD," meaning "to be determined," applied to a missing requirement means that the contractor should determine the missing requirement in coordination with the government. The term "TBS," meaning "to be specified," indicates that the government will supply the missing information in the course of the contract. The term "TBR," meaning "to be reviewed," implies that the requirement is subject to review for appropriateness by the contractor or the government. The government may change "TBR" requirements in the course of the contract.

GLMUIID12 — 1.3

1.3 Order of Precedence

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID13	1.3.0-1	The order of precedence of interface requirements documents is the UIID at the highest level, followed in order by the GIRD, ICD, and Instrument Description Document (IDD).

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID14	2	**2 Applicable Documents**
GLMUIID15	2.0-1	Reserved

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID16	3	**3 Allocations**
GLMUIID17	3.0-1	The GOES-R spacecraft provides communications, power and a platform for the GLM instrument. The following paragraphs allocate these resources to GLM.
GLMUIID18	3.1	**3.1 Command and Data Handling**
GLMUIID19	3.1.1	**3.1.1 Instrument-to-Spacecraft Science Rate**
GLMUIID20	3.1.1.0-1	The instrument science and engineering data rate, including all overhead associated with the Consultative Committee for Space Data Systems (CCSDS) packetization by the instrument, at the spacecraft interface **shall** not exceed 5 mega (10^6) bits per second when averaged over any 5 second period. *(CCR 00234)*
GLMUIID21	3.1.2	**3.1.2 Telemetry Data Rate**
GLMUIID22	3.1.2.0-1	Housekeeping telemetry data rate, including all overhead associated with CCSDS packetization by the instrument, at the spacecraft interface **shall** not exceed 1024 bits per second when averaged over any 5 second period.
GLMUIID23	3.1.3	**3.1.3 Application Process Identifiers**
GLMUIID24	3.1.3.0-1	The GLM **shall** use no more than 255 consecutive Application Process Identifiers (APIDs) for science, telemetry, and command packets.
GLMUIID25	3.2	**3.2 Power**
GLMUIID26	3.2.1	**3.2.1 Average Operational Power *(CCR 00246)***
GLMUIID27	3.2.1.0-1	The GLM average operational power, averaged over any 5 minute period, and including operational heater power, **shall** be no more than 260 watts. *(CCR 00246)*
GLMUIID28	3.2.2	**3.2.2 Maximum Operational Power *(CCR 00246)***
GLMUIID29	3.2.2.0-1	The GLM maximum operational power, averaged over any 20 ms period, and including operational heater power, **shall** be no more than 325 watts. *(CCR 00246)*
GLMUIID30	3.2.3	**3.2.3 Average Survival Power *(CCR 00240)***
GLMUIID31	3.2.3.0-1	When operational power is removed from GLM, the average survival power, averaged over any 72 minute period, **shall** be no more than the 92 watts. *(CCR 00246)*
GLMUIID96	3.2.4	**3.2.4 Maximum Survival Power *(CCR 00246)***
GLMUIID97	3.2.4.0-1	When operational power is removed from GLM, the maximum survival power, averaged over any 20 ms period, **shall** be no more than 130 watts. *(CCR 00246)*
GLMUIID32	3.3	**3.3 Mechanical**
GLMUIID33	3.3.0-1	The requirements in this section apply to the structural and mechanical components of the instrument flight units. *(CCR 00270)*
GLMUIID34	3.3.1	**3.3.1 Mass Properties**
GLMUIID35	3.3.1.0-1	The GLM, including all units and cabling between units, **shall** have mass less than *65* kilograms.
GLMUIID36	3.3.2	**3.3.2 Cabling Between Units**

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID37	3.3.2.0-1	If there are external units mounted directly to the spacecraft, the GLM **shall** accommodate any cable length between the units up to but not exceeding 2.5 meters. *(CCR 00270)*
GLMUIID51	3.3.2.0-2	Cables between GLM units will be the responsibility of the GLM contractor.

3.3.3 Volume

GLMUIID52   3.3.3

GLMUIID53   3.3.3.0-1

The GLM sensor and electronics units, including mounts, thermal blankets and connectors for both stowed and operational configurations, **shall** have dimensions that do not exceed the limits listed in the Instrument Unit Envelopes table.

Instrument Unit Envelopes Table

| Component	Width (cm) (X)	Height (cm) (Y)	Depth (cm) (Z)
Sensor unit*	80.0	65.0	150
Auxiliary Electronics	50.0	50.0	37.5

(CCR 00197) (CCR 00270)
*Discussion: For the sensor unit only, width is in the X direction of the body reference frame (BRF) defined in the GIRD. Height is measured in the Y direction of the BRF, and depth is in the Z direction of the BRF. For the electronic units, height is the direction normal to the mechanical interface plane.

GLMUIID98   3.3.3.0-2

In going from the stowed to the operational configuration, sensor unit depth (z-axis dimension) **shall** always be less than or equal to 170 cm. *(CCR 00349)*

3.3.4 Optical Port Field-of-View

GLMUIID55   3.3.4

GLMUIID56   3.3.4.0-1

The spacecraft **shall** provide the sensor unit's optical port a clear field-of-view within 30° of nadir as shown in the Optical Port Field-of-View Figure below. *(CCR 00349)*

Optical Port Field of View
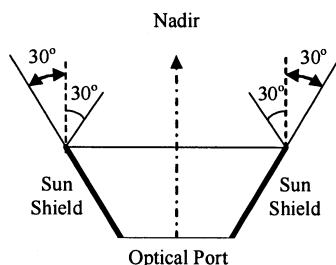
(CCR 00349)

3.3.5 Mounting

GLMUIID67   3.3.5

GLMUIID68   3.3.5.0-1

The spacecraft **shall** provide the instrument sensor unit a nadir-facing mounting surface.

GLMUIID69   3.3.5.0-2

The spacecraft mounting surface **shall** have as a minimum the same dimensions of the sensor unit envelope anti-nadir plane.

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID70	3.3.5.0-3	The sensor unit mechanical interface **shall** lie within the anti-nadir plane of the sensor unit envelope.
GLMUIID71	3.3.5.0-4	The instrument sensor unit **shall** use kinematic mounts for its mechanical interface to the spacecraft.
GLMUIID99	3.3.5.0-5	The instrument **shall** meet its performance requirements while the sensor unit is mounted to a rigid plate supported at three flexible points with a first mode between 20 and 30 Hz. *(CCR 00349)*
GLMUIID100	3.3.5.0-6	The instrument **shall** meet its performance requirements when the diagonal modal viscous damping factors associated with the three flexible points are 0.5%. *(CCR 00349)*
GLMUIID101	3.3.5.0-7	The placement of the GLM alignment reference frame with respect to the spacecraft IRU reference frame **shall** be to within 0.125 degrees per axis, including variation over all launch and on-orbit environments. *(CCR 00349)*
GLMUIID102	3.3.5.0-8	Nominal GLM mounting orientations **shall** have the instrument Z axis parallel to the spacecraft Z axis and the instrument Y axis either parallel to or anti-parallel to the spacecraft Y axis. *(CCR 00349)*
GLMUIID73	3.4	### 3.4 Thermal
GLMUIID74	3.4.0-1	The instrument electronics module total heat transfer to the spacecraft **shall** not exceed 200 Watts. *(CCR 00270)*
GLMUIID103	3.4.1	### 3.4.1 Cold Plate *(CCR 00349)*
GLMUIID104	3.4.1.0-1	The spacecraft **shall** provide the means (herein referred to as the cold plate) for the GLM sensor unit to reject heat. *(CCR 00349)*
GLMUIID105	3.4.1.0-2	The cold plate **shall** be located at the +Y surface of the allocated GLM sensor unit envelope. *(CCR 00349)*
GLMUIID106	3.4.1.0-3	The GLM vendor **shall** select a cold plate maximum operating temperature between 10°C and 25°C. *(CCR 00349)*
GLMUIID107	3.4.1.0-4	In normal operations, the spacecraft **shall** maintain the cold plate within 10°C of its maximum temperature. *(CCR 00349)*
GLMUIID108	3.4.1.0-5	In survival mode, the spacecraft **shall** maintain the cold plate temperature between -30°C and + 50°C. *(CCR 00349)*
GLMUIID109	3.4.1.0-6	Cold plate heat rejection **shall** be as shown in the following Cold Plate Heat Rejection Figure. *(CCR 00349)*

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ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID109	3.4.1.0-6	
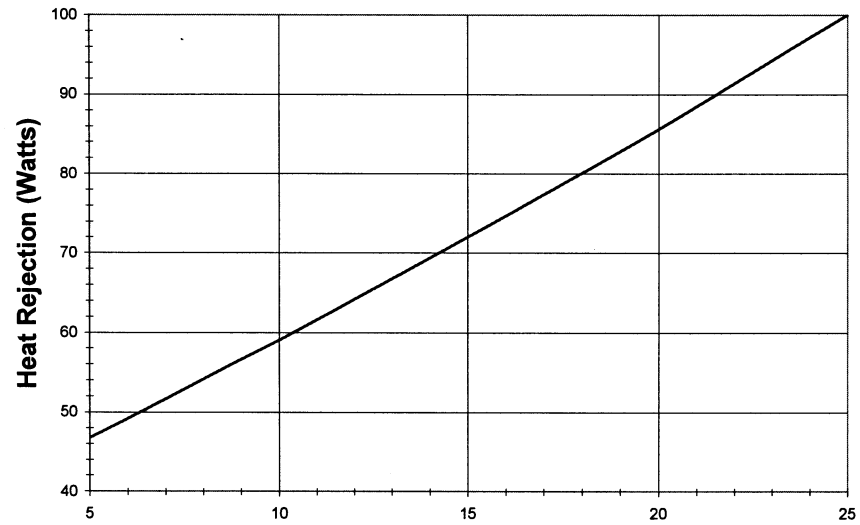
Cold Plate Heat Rejection Figure *(CCR 00349)*

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID75	4	**4 Constraints**
GLMUIID76	4.0-1	In order to ensure proper instrument performance or to prevent possible instrument damage, the following Government-approved constraints are imposed by the instrument developer on spacecraft integration and test activities, including launch, activation and operations. No constraints have been identified at this time.

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID77	5	**5 GIRD Deviations**
GLMUIID78	5.0-1	This section identifies GIRD requirements that the Government has deviated from for this instrument. Where appropriate, corresponding GIRD paragraph titles and numbers are identified in parentheses.
GLMUIID83	5.1	**5.1 SpaceWire Data Rate**
GLMUIID84	5.1.0-1	(GIRD requirement GIRD441 in Section 3.2.5.5, SpaceWire Data Rate, is not applicable to the GLM instrument and is superceded by the following requirement) Data transferred over the SpaceWire data bus **shall** be clocked at 10 MHz. Note: This clock rate allows for a 8 Mbps data rate accounting for SpaceWire overhead.
GLMUIID85	5.2	**5.2 Instrument to Spacecraft Disturbances (CCR 00240)**
GLMUIID86	5.2.0-1	The following instrument requirements apply during the operational mode of the spacecraft. *(CCR 00240)*
GLMUIID90	5.2.1	**5.2.1 Instrument Disturbance Torque Limits (CCR 00240)**
GLMUIID92	5.2.1.0-1	(GIRD requirement GIRD160 in Section 3.2.1.7.2.1 titled Instrument Disturbance Torque Limits is not applicable to the GLM instrument and is superseded by the following requirement.) *(CCR 00240)*
GLMUIID93	5.2.1.0-2	The sum of the magnitude of the instrument sensor unit's uncompensated torques and the magnitude of its uncompensated linear forces multiplied by a lever arm of 2 meters **shall** not exceed 0.001 N-m (TBR). *(CCR 00240)*
GLMUIID89	5.2.2	**5.2.2 Instrument Allowable Angular Momentum (CCR 00240)**
GLMUIID94	5.2.2.0-1	(GIRD requirement GIRD163 in Section 3.2.1.7.2.2 titled Instrument Allowable Angular Momentum is not applicable to the GLM instrument and is superseded by the following requirement.) *(CCR 00240)*
GLMUIID95	5.2.2.0-2	The magnitude of the instrument sensor unit's uncompensated angular momentum **shall** not exceed 0.001 N-m-sec (TBR). *(CCR 00240)*
GLMUIID110	5.3	**5.3 Spacecraft Attitude Knowledge (CCR 00349)**
GLMUIID111	5.3.0-1	This section establishes separate static, slow dynamic and fast dynamic attitude knowledge requirements and supersedes GIRD635 and GIRD1088. *(CCR 00349)*
GLMUIID112	5.3.0-2	The attitude data provided by the spacecraft **shall** have a static error less than 1200 microradians (3σ).*(CCR 00349)*
GLMUIID113	5.3.0-3	The attitude data provided by the spacecraft **shall** have a diurnal error less than 30 microradians (3σ), where "diurnal error" refers to that portion of the error that repeats from day-to-day. *(CCR 00349)*
GLMUIID114	5.3.0-4	The attitude data provided by the spacecraft **shall** have a dynamic error (non-static and non-diurnal) less than 30 microradians (3σ). *(CCR 00349)*

ID	Object Number	417-R-GLMUIID-0058, RM Version, Geostationary Lightning Mapper (GLM) Unique Instrument Interface Document (UIID)
GLMUIID79	6	**6 Acronyms**

GLMUIID80   6.0-1

APID	Application Process Identifier
C&DH	Command and Data Handling
CCSDS	Consultative Committee for Space Data Systems
GIRD	General Interface Requirements Document
GLM	Geostationary Lightning Mapper
GOES	Geostationary Operational Environmental Satellite
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
IDD	Instrument Description Document
NASA	National Aeronautics and Space Administration
PORD	Performance and Operational Requirements Document
TBD	to be determined
TBR	to be resolved
TBS	to be specified
UIID	Unique Instrument Interface Document

417-R-GLMUIID-0058 DCR

CCR #: 00234   Rev
Contract # NNG0 - Info 6HX12C, 6HX11C, 6HX13C
CCB Status: **Approved**
CCB Date: 6/14/2006
Contract Mod#:
Doc Change Date: 6/14/2006

Title: GLM Science Data Bandwidth Increase
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.1.1
DOORS Version: GLMUIID 0.0
DOORS ID #: GLMUIID20 (3.1.1.0-1)

CCR #: 00197   Rev
Contract # NNG0 - Info 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 8/1/2006
Contract Mod#:
Doc Change Date: 8/1/2006

Title: GLM Volume Increase
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.3.3
DOORS Version: GLMUIID 0.0
DOORS ID #: GLMUIID53 (3.3.3.0-1)

CCR #: 00240   Rev
Contract # NNG0 - Info 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 7/26/2006
Contract Mod#:
Doc Change Date: 8/1/2006

Title: GLM Disturbance Torque and Angular Momentum Limits
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   5.2(new), 5.2.1, 5.2.2
DOORS Version: GLMUIID 1.0
DOORS ID #: GLMUIID(TBD)

CCR #: 00246   Rev
Contract # NNG0 - Info 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 7/26/2006
Contract Mod#:
Doc Change Date: 8/1/2006

Title: GLM Survival Power Limits
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.2.1, 322, 3.2.3, 3.2.4 (new)
DOORS Version: GLMUIID 1.0
DOORS ID #: GLMUIID26 (3.2.1), 27 (3.2.1.0-1), 28 (3.2.2), 29 (3.2.2.0-1), 30 (3.2.3), 31 (3.2.3.0-1), TBD (3.2.4), TBD (3.2.4.0-1)

CCR #:   00269   Rev
Contract # NNG0 - Info 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 8/10/2006
Contract Mod#:
Doc Change Date: 8/10/2006

Title: GLM Cold Plate Thermal Limits
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.3.5
DOORS Version: GLMUIID 1.1
DOORS ID #: GLMUIID59 (3.3.5.0-1)

CCR #:   00270   Rev
Contract # NNG0 - Info 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 8/10/2006
Contract Mod#:
Doc Change Date: 8/10/2006

Title: Eliminate Reference to Auxiliary Electronics Box
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.3, 3.3.2, 3.3.3, 3.4
DOORS Version: GLMUIID 1.1
DOORS ID #: GLMUIID33 (3.3.0-1), GLMUIID37 (3.3.2.0-1), GLMUIID53 (3.3.3.0-1), GLMUIID74 (3.4.0-1)

CCR #: 00349   Rev
Contract # NNG0 - 6HX11C, 6HX12C, 6HX13C
CCB Status: **Approved**
CCB Date: 12/27/200
Contract Mod#:
Doc Change Date: 12/27/2006

Title: GLM UIID Clean-Up
GOES S/C: R Effectivity: GLM Instrument

Doc #: 417-R-GLMUIID-0058
Doc Section   3.3.3, 3.3.4, 3.3.5, 3.3.6, 3.4.1, 5.3
DOORS Version: GLMUIID 1.2
DOORS ID #: See change pages